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Odontogenic infections in the head and neck: a case series

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ABSTRACT

Introduction Odontogenic infections (OIs) are potentially severe complications resulting from untreated dental pathologies or incorrect dentistry procedures. They may involve paranasal sinuses and cervico-fascial spaces. Clinical picture can be misleading and relation with dental pathology unapparent, making their diagnosis challenging.
Material and methods Data of 44 patients referred to San Raffaele Hospital (Milan) for acute severe or recalcitrant sinonasal/deep cervical OIs between January 2008 and January 2017 were retrospectively collected. Clear odontogenic origin was proved in all cases. Patient characteristics, etiopathogenesis, surgical approach and medical therapy were individually assessed.
Results Main causes of OIs were implant placement (13/44, 29.6%) and caries (12/44, 27.3%), followed by dysodontiasis (8/44, 18.2%), tooth extraction (7/44, 15.9%), endodontic procedures (2/44, 4.5%) and sinus lift (2/44, 4.5%). A clear etiology was detectable in 27 patients (61.4%). Odontogenic maxillary sinusitis (32/44, 72.7%) was typically tackled by a multiportal approach, with transnasal endoscopic approaches combined with transoral ones. Cervico-fascial infections (12/44, 27.3%), instead, always required cervicotomic surgical drainage, frequently in urgent/emergent settings. A case of descending mediastinal spread was recorded.
Conclusions High index of suspicion and effective collaboration between dental and ENT specialists are essential to promptly diagnose and treat OIs. Antibiogram-driven therapies and multiportal approaches are key elements of the current therapeutic strategy.

KEYWORDS Caries; Deep neck space infection; Dental implant; Maxillary sinusitis; Odontogenic infection; Odontogenic sinusitis.

INTRODUCTION

Odontogenic infections (OIs) are pathologies originating from the stomatognathic system as complications of dental pathologies or dentistry procedures. If not promptly diagnosed and treated, they can rapidly spread throughout many head and neck compartments and, depending on the etiology and the area where they started, give rise to severe, life-threatening complications (1-3). Not only are delayed diagnosis and inappropriate treatment relevant for development of OIs, but also general comorbidities of patients are highly relevant: diabetes, autoimmune or lymphoproliferative disorders, renal failure, osteoporosis, malnutrition, smoking, alcohol abuse, and chronic assumption of steroids are all factors which can increase the incidence of OIs (1, 2).
OIs may develop both in the upper and the lower regions of the head and neck area. Upper ones comprise spaces near the superior dental arch, namely the paranasal sinuses, with maxillary sinus involved in the majority of cases (4). Odontogenic maxillary sinusitis (OMS) accounts for about 10-30% of chronic antral inflammation (2) and 8% of conditions treated by endoscopic nasal surgery (5). Lower regions are characterized by the proximity of the inferior dental arch to the fascial cervical spaces: superficial, submental, submandibular, sublingual, parapharyngeal, masticator, carotid, retropharyngeal, prevertebral, and the danger space which extends from the skull base to the posterior mediastinum (3, 6, 7). An odontogenic etiology accounts for as many as 57% of cervical-fascial infections (8).
Diagnosis of OIs can be challenging: signs and symptoms are often non-specific or misleading (especially for OMS) and the relation with clear dental pathology is frequently unapparent or underrated. Dental symptoms (local pain or hypersensitivity), in fact, do not reliably correlate with an odontogenic etiology (2, 9). This may hinder prompt and effective treatment, leading to recalcitrant symptoms and severe complications (10). Clinical presentation is obviously different between upper and lower OIs: facial pain/pressure, posterior nasal drip, rhinorrhoea, nasal obstruction, hyposmia/cacosmia, and rotten taste occur in the former, while sore

throat, odynophagia, dyspnea, an enlarging neck lump, and more serious systemic involvement characterized the latter. Fever is often present (2-4, 7).

Accurate and clear diagnosis implies not only detection of the complication, but also the specific cause of the infection, allowing correct dental therapy and decreasing the risk of recurrence (10).

In the present study, we reviewed our experience as a tertiary referral centre by analyzing the different pathogeneses that may lead to OIs and underscoring the importance of cooperation between dentists and otolaryngologists to effectively manage potentially troublesome, severe complications.

MATERIALS AND METHODS

The study was carried out retrospectively on a series of 44 patients referring to San Raffaele Hospital (Milan) between January 2008 and January 2017 for acute severe or recalcitrant sinonasal/deep cervical OIs requiring hospital admission in the ENT department. The original cohort included 60 cases, but we excluded patients whose exact odontogenic etiopathology could not be determined from charts or who were subsequently lost to follow-up (minimum follow-up: 6 months). Records were collected from the Dental-ENT combined database of the institution. All performed procedures were in accordance with the ethical standards of the institutional and/or national research committee and with the principles stated in the Declaration of Helsinki "Ethical Principles for Medical Research Involving 'Human Subjects", adopted by the 18th World Medical Assembly, Helsinki, Finland, June 1964, and as amended most recently by the 64th World Medical Assembly, Fortaleza, Brazil, October 2013. No Ethics Committee approval was needed due to the pure retrospective nature of the study. All patients were evaluated by both dental and ENT specialists. The cohort included 21 men (47.7%) and 23 women (52.3%) with a mean age of 51.27 ± 18.72 years (range: 10-85) at the time of hospital admission (53.38 ± 18.70 years for upper OIs, 44.42 ± 17.85 years for lower OIs).

Disease extension and underlying dental pathologies were assessed through sinus (for upper OIs) or neck (for lower OIs) computed tomography (CT) (contrast-enhanced for lower OIs) and orthopantomograph (OPG) in all cases. Deep neck involvement was also evaluated with neck ultrasound (US) or magnetic resonance imaging (MRI), if the exact relation with the cervical neuro-vascular bundle or thoracic outlet was needed. Revaluations of upper OIs were performed through cone beam volumetric CT (CBVCT) when feasible.

Pathological specimens (i.e. pus samples) aseptically collected from surgical drainage of infectious foci were analyzed by both microbiological culture and histology (etiologies are listed in Table 1); this latter evaluation was essential to differentiate fungal from bacterial sinusitis, demonstrating the presence of hyphae.

Whenever purely medical therapy was ineffective due to recalcitrant symptoms or typically surgical indications were noticed (peri-implant osteitis, implant dislocation, oro-antral communication, radiologically-suspected fungus ball, deep neck abscesses), patients underwent functional endoscopic sinus surgery (FESS), eventually combined with transoral or external (Caldwell-Luc) approaches, for OMS and cervicotomic surgical drainage for odontogenic cervical-fascial infections (OCFI). FESS was generally performed with a minimally invasive approach: inferior partial uncinectomy, anterior ethmoidectomy, a wide middle meatal antrostomy eventually enlarged posteriorly as far as the vertical process of the palatine bone, maxillary sinus washing and drainage/removal of pus and infected grafting materials. Concomitant septoplasty was carried out if septal spurs encroaching the ostiomeatal complex were intraoperatively noticed. Frontal sinusotomy, posterior ethmoidectomy, or sphenoidotomy were not performed when radiological involvement was demonstrated. Oral approaches for upper OIs were used to manage critical areas (namely the alveolar recess of the maxillary sinus, which is hard-to-reach endoscopically), close oro-antral communications (OAC) with removal of diseased mucosa and bone and harvesting of tension-free local flaps (vestibular advancement flap with or without concurrent buccal fat pad flap), remove dislocated/failed implants and treat the concurrent dental pathology. All surgical procedures were performed under general anesthesia with oro-tracheal intubation.

Independently of the surgical approach chosen, all patients received postoperative antibiotic therapy for at least 8-10 days, empirically at first, and antibiogram-driven when available (Table 2). In some cases steroids were administered (typically intravenous methylprednisolone, 40 to 80 mg/day, subsequently tapered), especially in the most symptomatic patients.

Mean hospital stay was 4.76 ± 6.31 days (3.64 ± 7.27 days for upper OIs, 6.92 ± 3.06 days for lower OIs). A case of parapharyngeal abscess with subsequent mediastinal spread was excluded from the count, since it required a 93-day stay (including ICU permanence). Patients were generally followed-up at 7, 20, and 60 days after discharge; those undergoing more intensive surgery initially required weekly examinations for longer periods. Average follow-up duration was 10.7 ± 4.3 months (range: 6-15).

RESULTS

The patient demographics and characteristics of OIs are shown in Table 1, stratified according to involvement of upper or lower district. Upper OIs were OMS in 29 cases (90.7%), palatal abscesses in 2 (6.2%), and canine fossa

		Overall OIs	Upper OIs	OCFI
Incidence		44 (100%)	32 (72.7%)	12 (27.3%)
Genre	Male	21 (47.7%)	14 (43.7%)	7 (58.3%)
	Female	23 (52.3%)	18 (56.3%)	5 (41.7%)
Age (ys)	< 20	1 (2.3%)	1 (3.1%)	/
	21-40	11 (25.0%)	5 (15.6%)	6 (50.0%)
	41-60	14 (31.8%)	10 (31.3%)	4 (33.3%)
	61-80	17 (38.6%)	15 (46.9%)	2 (16.7%)
	> 80	1 (2.3%)	1 (3.1%)	/
Side	Right	18 (40.9%)	11 (34.4%)	7 (58.3%)
	Left	26 (59.1%)	21 (65.6%)	5 (41.7%)
Causes	Tooth extraction	7 (15.9%)	6 (18.7%)	1 (8.3%)
	Implant	13 (29.6%)	11 (34.5%)	2 (16.7%)
	Caries	12 (27.3%)	5 (15.7%)	7 (58.3%)
	Dysodontiasis	8 (18.2%)	6 (18.7%)	2 (16.7%)
	Endodontic procedures	2 (4.5%)	2 (6.2%)	/
	Sinus lift	2 (4.5%)	2 (6.2%)	/
	Pre-implantological	2 (4.5%)	2 (6.1%)	/
	Implantological	13 (29.6%)	11 (34.4%)	2 (16.7%)
	"Classic" dental	29 (65.9%)	19 (59.5%)	10 (83.3%)
Etiologies	S. aureus	4 (9.1%)	3 (9.4%)	1 (8.3%)
	AHS	9 (20.6%)	7 (21.9%)	2 (16.7%)
	BHS	6 (13.6%)	3 (9.4%)	3 (25%)
	Enterobacter spp	2 (4.5%)	2 (6.2%)	/
	E. corrodens	1 (2.3%)	1 (3.1%)	/
	K. pneumoniae	3 (6.8%)	3 (9.4%)	/
	Obligate anaerobes*	2 (4.5%)	/	2 (16.7%)
	MOF	12 (27.2%)	9 (28.1%)	3 (25%)
	Culture-negative	5 (11.4%)	4 (12.5%)	1 (8.3%)
	Aspergillus spp	3 (6.8%)	3 (9.4%)	/

OIs: odontogenic infections; OCFI: odontogenic cervico-fascial infections; AHS: alpha-hemolytic streptococci; BHS: beta-hemolytic streptococci; MOF: non-specific mixed oropharyngeal flora (not otherwise specified)
* Obligate anaerobes include Peptostreptococci spp, Propionibacterium spp, Bacteroides spp, Actinomyces spp

TABLE 1 Patient features and characteristics of infections stratified according to the districts involved.

abscess in one (3.1%). Cervical-fascial spaces were involved as follows: submental space in 2 cases (16.7%), submandibular in 7 (58.3%), masticator in 2 (16.7%), and parapharyngeal with descending mediastinal spread in one (8.3%).
Causes of OIs included tooth extractions (7 cases; 15.9% overall), implant placement (13; 29.6%), caries (12; 27.3%), dysodontiasis (8; 18.2%), previous endodontic procedures (2; 4.5%), and maxillary sinus floor elevation or "sinus lift" (2; 4.5%). They are also divided into complications of pre-implantological (2; 4.5%) or implantological treatment (13; 29.6%), and consequences of "classic" dental procedures (i.e. tooth extractions, endodontic procedures), or tooth decay (i.e. caries) or dysodontiasis (29; 65.9%), according to Felisati's proposal of classification (11).
A clear etiology was detectable in 27 patients (61.4%, Table 1). Microbiological cultures of surgical specimens

were negative in 5 cases (11.4%) or demonstrated non-specific mixed oropharyngeal flora (MOF) growth in 12 (27.2%). Thus, antibiogram-driven therapy was applied in the majority of patients. Three (6.8%) purely mycotic infections (Aspergillus spp) were observed as maxillary sinus mycetomas, with concurrent MOF isolation.

Table 2 shows the type of surgical treatment and adjuvant medical therapy (antibiotics with or without concurrent steroids) used. Cervicotomic surgical drainage with necrotic tissue debridement combined with dental procedures aimed at resolving concurrent dental pathologies was exploited in all OCFI (12 cases). A recurrent infection developed in one case after surgical intervention (i.e. parapharyngeal abscess as a consequence of prolonged, untreated tooth decay), with retropharyngeal and subsequent descending mediastinal spread along the danger space. The patient required an additional thoracotomy approach and extensive ICU stay following the procedure.

Conversely, upper OIs (32 patients) were managed through an exclusively trans-nasal endoscopic functional approach (FESS) in 11 cases (34.4%) or with a combined approach (FESS with concomitant transoral or Caldwell-Luc approaches) in 18 (56.2%). Three upper OIs (2 hard palate and one canine fossa abscesses; 9.4%) were addressed with transoral surgical drainage without concurrent FESS.

DISCUSSION

The oral cavity is the anatomical region with the highest presence of bacteria: for instance, the number of microorganisms in a diseased gingival periodontal pocket can be as high as 1.8 x 1011/g of material (12). Therefore, all oral procedures should be carried out by

		Overall OIs	Upper OIs	OCFI
Antibiotics	PEN	20 (45.6%)	16 (50.0%)	4 (33.3%)
	CEP	1 (2.2%)	1 (3.1%)	/
	FLU	12 (27.3%)	12 (37.5%)	/
	PEN + LIN	5 (11.4%)	3 (9.4%)	2 (16.8%)
	PEN + TET	1 (2.2%)	/	1 (8.3%)
	CEP + LIN	4 (9.1%)	/	4 (33.3%)
	CEP + MAC	1 (2.2%)	/	1 (8.3%)
	Monotherapy	33 (75.0%)	29 (90.6%)	4 (33.3%)
	Combination therapy	11 (25.0%)	3 (9.4%)	8 (66.7%)
	Empirically	17 (38.6%)	13 (40.6%)	4 (33.3%)
	Antibiogram-driven	27 (61.4%)	19 (59.4%)	8 (66.7%)
Steroids	Yes	14 (31.8%)	8 (25.0%)	6 (50.0%)
	No	30 (68.2%)	24 (75.0%)	6 (50.0%)
Surgery	FESS	11 (25.0%)	11 (34.4%)	/
	FESS + CL	2 (4.5%)	2 (6.2%)	/
	FESS + DP*	8 (18.2%)	8 (25.0%)	/
	FESS + TO**	8 (18.2%)	8 (25.0%)	/
	Surgical drainage*** + DP*	15 (34.1%)	3 (9.4%)	12 (100.0%)

OIs: odontogenic infections; OCFI: odontogenic cervical-fascial infections; PEN: penicillin; CEP: cephalosporin; LIN: lincosamide; FLU: fluoroquinolone; TET: tetracycline; MAC: macrolide; FESS: functional endoscopic sinus surgery; CL: Caldwell-Luc approach; TO: transoral approach; DP: dental procedure

* Dental procedure includes purely dental interventions such as tooth extractions or endodontic procedures

** Transoral approaches were performed to dominate critical areas (i.e. alveolar recess of the maxillary sinus), close oro-antral communications with removal of diseased mucosa and bone and harvesting of tension-free local flaps (vestibular advancement flap with or without concurrent buccal fat pad flap), remove dislocated/failed implants

*** Surgical drainage through cervicotomy for OCFI and by incision of palatal or canine fossa abscesses for superior OIs

TABLE 2 Surgical procedures and associated medical therapy (antibiotics with or without concurrent steroids) stratified according to the districts involved.

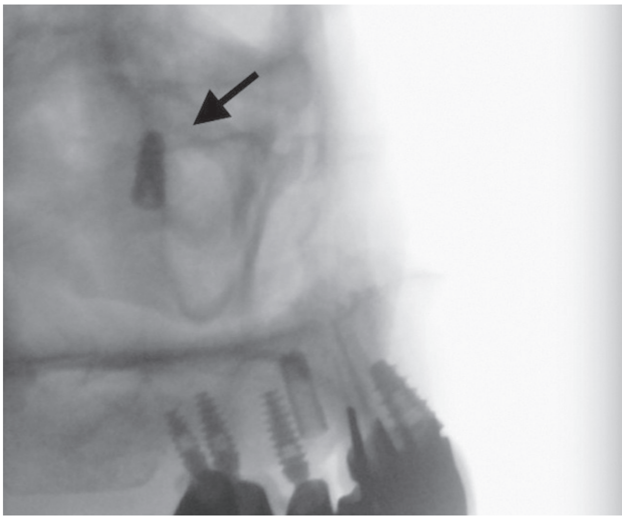

FIG. 1 A

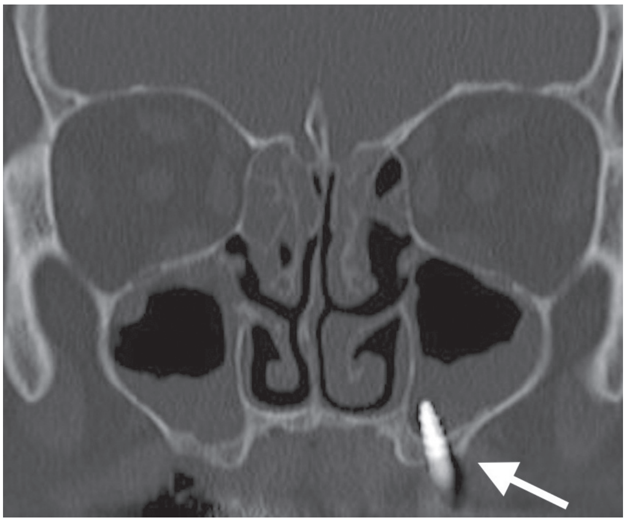

FIG. 1 B

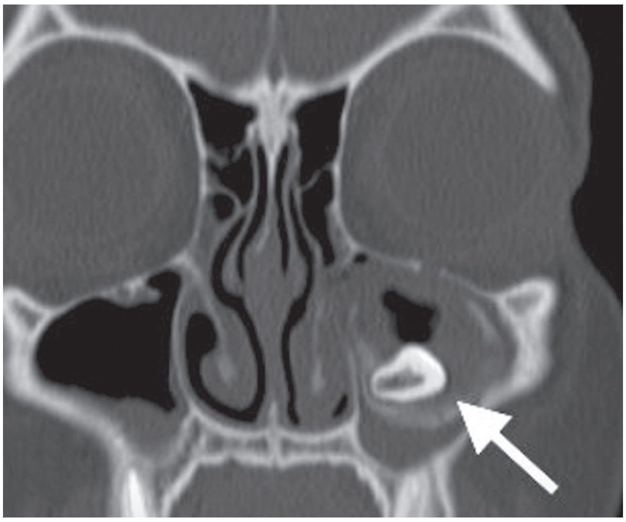

FIG. 1 C

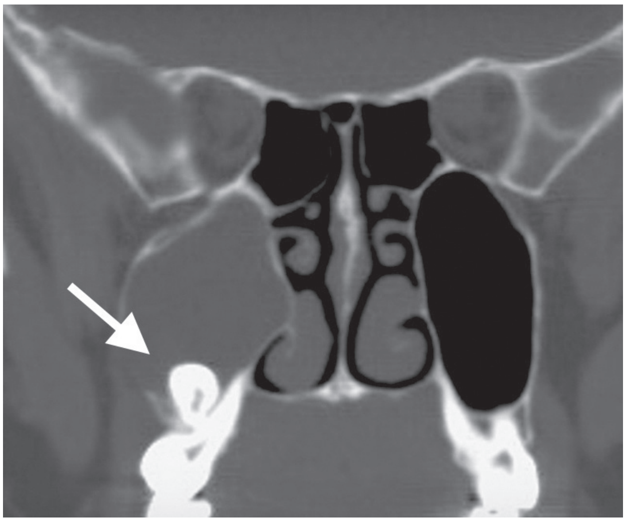

FIG. 1 D

FIG. 1 A-B Superior dental implant displaced within the maxillary sinus cavity, up to its roof (black arrow, A) or emerging from its floor (white arrow, B). C-D Molar teeth retained within maxillary sinus cavity (white arrows), a clear example of upper arch dysodontiasis and consequent sinonasal inflammatory reaction.

minimizing the risk of secondary infections and possible systemic bacterial spread.

OIs are commonly encountered entities in daily dental-ENT practice, especially in adults: an odontogenic pathogenesis is detectable in 10-30% of maxillary sinusitis (2) and almost 50% of cervical-fascial infections (6). However, their prevalence remains largely underestimated, due to non-specific clinical presentation, compared to their non-odontogenic counterparts, and unpredictable course (2, 6).

As previously stated, OIs are potentially invasive complications because of the proximity of the oral region to other anatomical spaces of the head and neck, namely the paranasal sinuses (upper OIs) and the deep cervical-fascial spaces (lower OIs or OCFI) (2-7). Within our series, the main causes of OIs were implant placement (13/44, 29.6%) and caries (12/44, 27.3%), followed by dysodontiasis (8/44, 18.2%), tooth extraction (7/44, 15.9%), endodontic procedures (2/44, 4.5%), and sinus lift (2/44, 4.5%). However, stratifying the pathogenesis according to involved districts, implant placement becomes preponderant in determining OMS (11/32, 34.4%), and caries in OCFI (7/12, 58.3%). This finding is consistent with literature data (6, 13).

In the last years, the use of implants for rehabilitation of edentulous patients has widely increased. These devices are very useful and successful, also in immunocompromised patients (14), but their placement is not always easy or safe to perform, especially by inexperienced surgeons (4). Superior implant displacement (Fig. 1 A, B), in fact, can perforate the Schneiderian's membrane of the ipsilateral maxillary

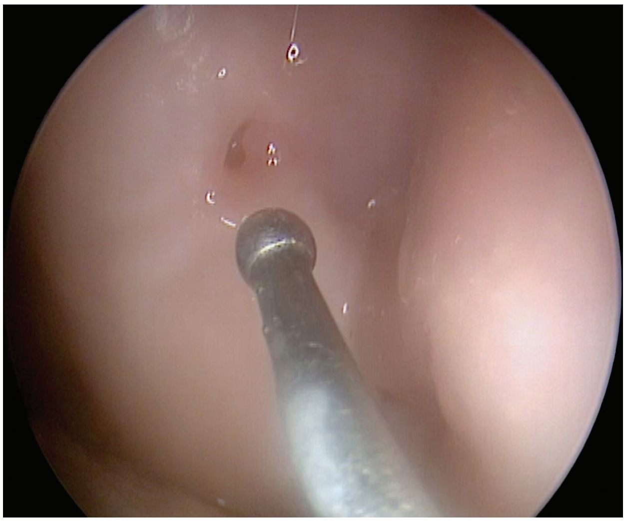

FIG. 2 A

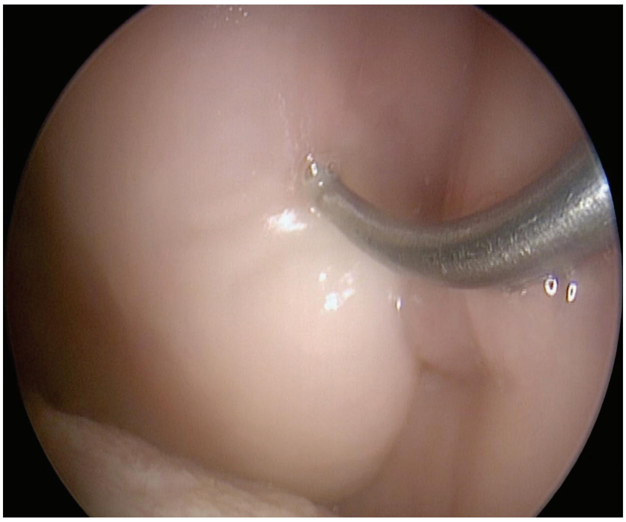

FIG. 2 B

FIG. 2 Endoscopic view of a probe approaching an oro-antral communication on a left upper dental arch resulting from an incorrect tooth extraction (A); purulent discharge coming from the fistula as a result of probe insertion (B).

sinus, leading to a foreign body reaction and altering sinonasal mucociliary clearance; thus, stasis of inflammatory components within the sinus causes OMS (14, 15). It occurs easily with an atrophic alveolar process (13, 16) or with concurrent sinonasal pathology (i.e. ostiomeatal complex dysventilation due to ipsilateral septal deviation, concha bullosa, paradoxical middle turbinate, bulky ethmoid bulla) (14). Moreover, even a well-placed implant in a patient with underlying risk factors (e.g. pre-existing sinonasal pathology, diabetes, malnutrition, smoking, chronic assumption of steroids, osteoporosis) may undergo osseointegration failure and result in OIs (1), as do failed pre-implantological procedures (4, 14, 17). Indeed, maxillary sinus floor elevation with bone graft may lead to severe OIs (4, 14, 17), even if mini-invasive techniques have recently been proposed (18, 19).

While implant placement can easily alert most dentists and oral surgeons about possible complications, common tooth decay and dysodontiasis are largely underestimated. However, these are frequent causes of OIs, especially OCFI (6, 18), as confirmed in our series (9/12, 75.0%). When tooth decay (i.e. caries) is left untreated for long periods, bacterial load is high and there are underlying predisposing conditions (e.g. periodontal disease, diabetes, immunosuppression), a spread of the infection from the hard dental tissue to the pulp and the periodontal tissues may occur, making subsequent diffusion through alveolar bone to cervical fascial spaces easier (6, 18). The same is true for dysodontiasis (19) (Fig. 1 C, D), a condition that may promote OMS and OCFI through tooth decay (19), dental cyst formation, and resulting granulomatous inflammatory response (20) or traumatic damages associated with extraction of impacted teeth (16, 21). Neck deep spaces, in particular, are potential planes of low resistance that become engorged with inflammatory exudate and pus in case of infection, producing airway compression, descending mediastinal or systemic spread, major blood vessel erosion, and life-threatening thrombosis/hemorrhage, with considerable morbidity and mortality in up to 40% of cases (6).

Tooth extraction has also been reported as common cause of OIs (11, 12, 22). If not correctly performed, the procedure may lead to post-extraction alveolitis, with or without displacement of dental roots in the overhanging maxillary sinus, and/or OAC formation (Fig. 2) (11, 12, 22). Risk factors are the presence of divergent roots, severe tooth decay, and wide dental restorations, since these conditions can facilitate fracture of the tooth (22).

Another cause of OIs (especially OMS) is endodontic therapy, whose materials or instruments may emerge from the root canal apex reaching the maxillary sinus cavity. This frequently gives rise to fungal colonization of the sinus, with Aspergillus spp "fungus ball" the most common clinical manifestation (23-25). Within our series, we observed 3 maxillary sinus mycetomas (Fig. 3), resulting from failure of endodontic procedures (2/3) or implant placement (1/3).

The etiologies of our OIs are consistent with other well-known series in literature (26, 27): alpha-hemolytic streptococci (i.e. viridans group) were the most frequent specific bacteria isolated from pus samples (9/44, 20.6%), followed by beta-hemolytic streptococci (i.e. S. pyogenes and S. agalactiae; 6/44, 13.6%), gram-negative species (i.e. K. pneumoniae, E. corrodens and Enterobacter spp; 6/44, 13.6%), S. aureus (4/44, 9.1%), and obligate anaerobes (2/44, 4.5%). However, pathological specimens did not contain any microbial

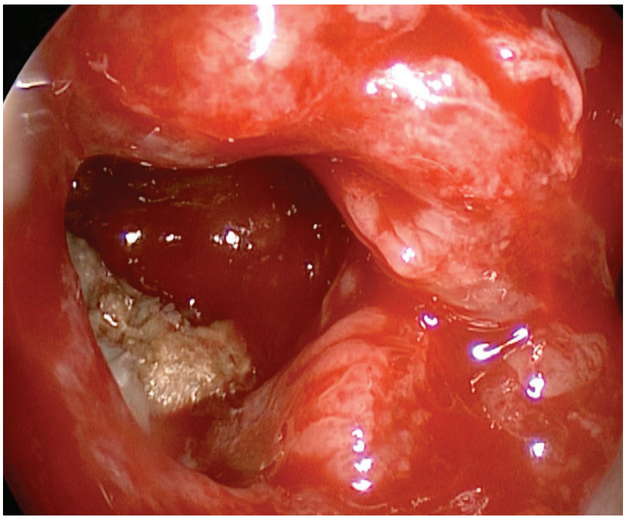

FIG. 3 A

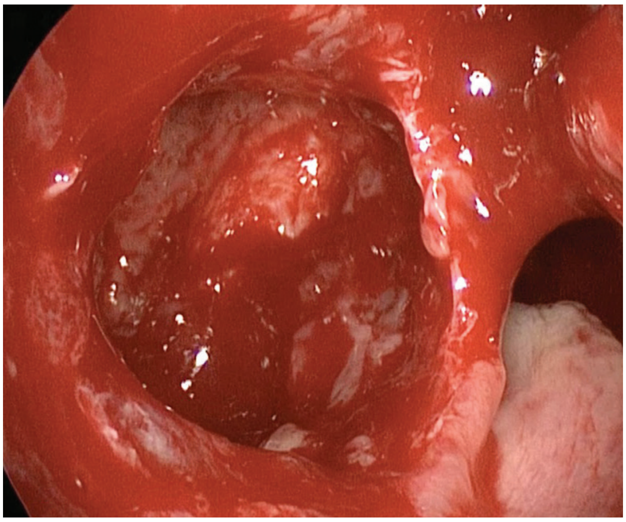

FIG. 3 B

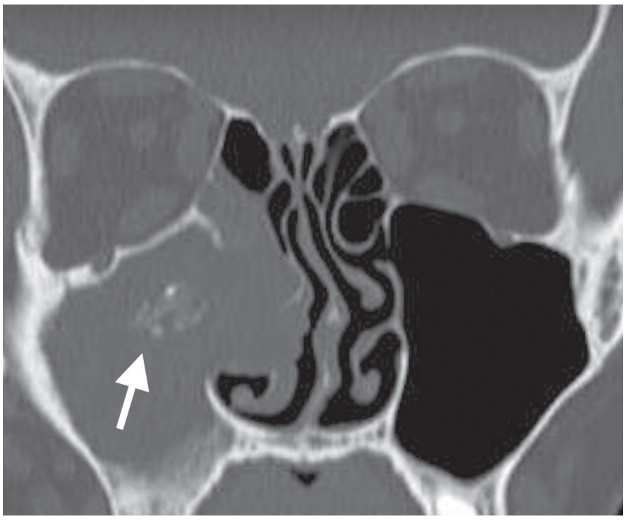

FIG. 3 C

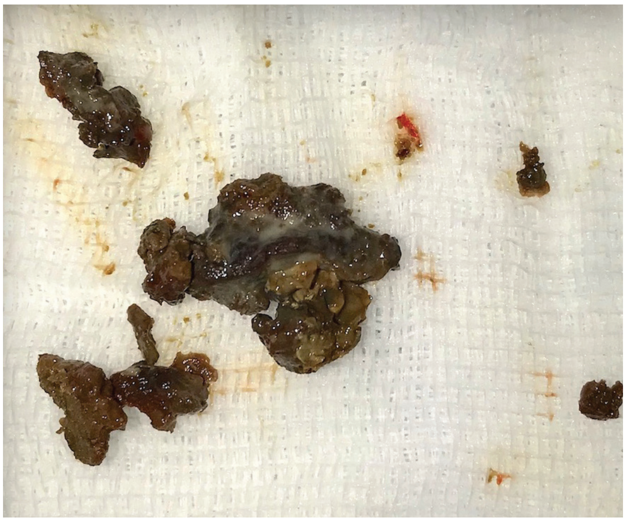

FIG. 3 D

FIG. 3 A-B Intraoperative endoscopic view of maxillary sinus Aspergillus mycetomas, resulting from failed endodontic procedures, after middle meatal antrostomy (A) and its removal with consequent sinus drainage (B). C Typical iron-like signalling (arrow) within complete inflammatory obliteration of the sinus in CT scan. D Specimen of fungal colonisation.

growth in 5 cases (11.4%) and only non-specific mixed oropharyngeal flora isolation in 12 (27.2%); this evidence is not unusual (26, 27), since OIs are often polymicrobial (2), but it makes the choice of the best antibiotic particularly challenging, providing the need for combination, intravenous, broader-spectrum therapies.

As far as OCFI are concerned, treatment is almost always characterized by urgent/emergent cervicotomic surgical drainage of abscessual collections (Fig. 4). It is nonetheless mandatory to recognize several "red flags": rapid progressive swelling, worsening trismus, shortness of breath/tachypnea, dysphonia, dysphagia, pyrexia, or recent onset of neck stiffness are all unequivocal signs of poor course and must be promptly addressed to avoid significant morbidity and risk of death (6, 7). Within our series, we had a case of relapsing infection after successful cervicotomic drainage of a parapharyngeal abscess with retropharyngeal and subsequent descending mediastinal spread along the danger space. It required a combined approach (cervicotomy and thoracotomy) and prolonged ICU stay with aggressive intravenous therapy. Prompt identification of worsening of the clinical course was essential to save the patient. A high index of suspicion must always be maintained in dealing with OCFI, even after apparently successful drainage: vital signs, temperature, complete blood count, RCP, neck palpation, and direct fiberoptic laryngoscopy should be routinely repeated in the postoperative setting (6, 7).

OMS, on the other hand, are often managed multiportally, with transnasal endoscopic approaches

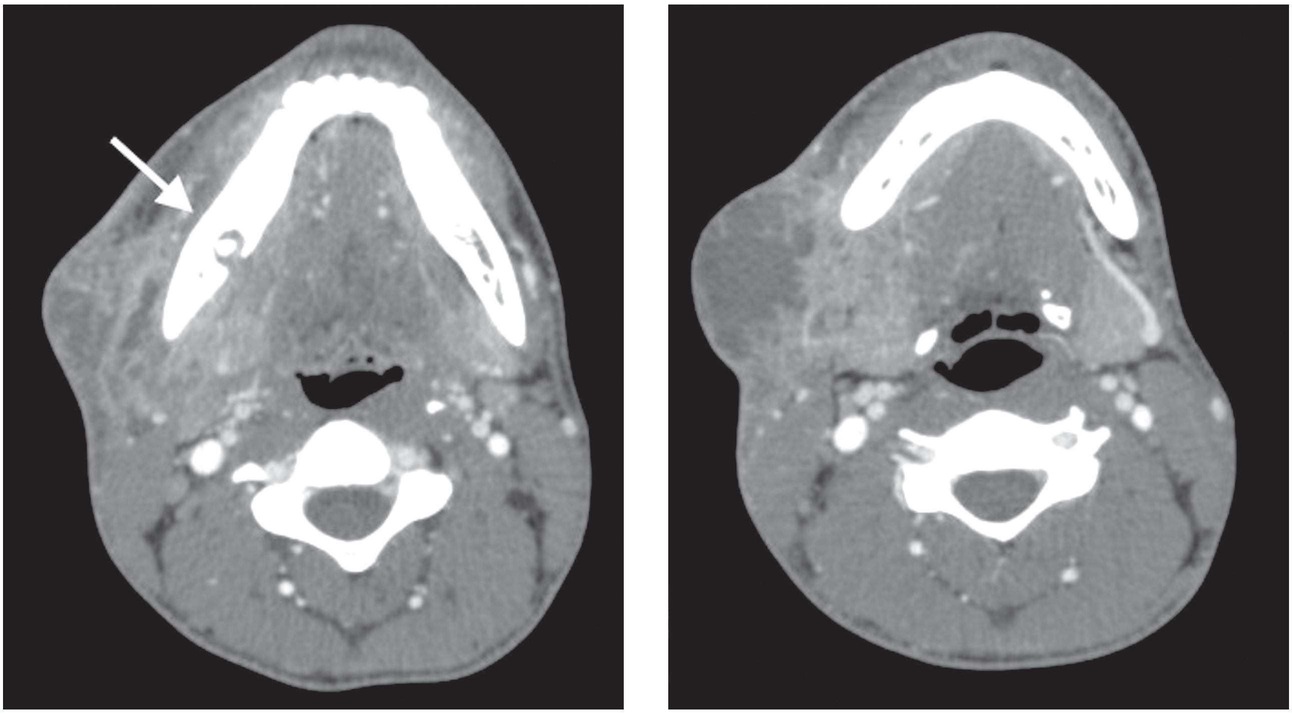

FIG. 4 A

FIG.4 B

FIG. 4 Periapical periodontitis on a right lower dental arch (A, arrow) with associated abscessual collection extending from the submandibular space in the buccal one (B).

(i.e. FESS) combined with transoral ones (e.g. root canal treatment, extractions, implant removal, OAC closure) (11). In our series, this circumstance occurred in half of cases (16/32, 50.0%). Many OMS treated with exclusive FESS approach had already undergone oral clean up elsewhere before coming to our attention. The Caldwell-Luc procedure has been nowadays almost abandoned due to its greater morbidity, with limited indications in case of large retained foreign bodies within the maxillary sinus cavity (28, 29). In fact, we used the procedure in only very few cases (2/32, 6.2%).

CONCLUSION

Delays in patient presentation to appropriate healthcare specialists, diagnosis, and outset of appropriate treatment are the main causes of recalcitrant/progressive course of OIs, leading to severe, life-threatening complications (2, 6). This is particularly true in an era of increasing antibiotic-resistance, as the present scenario widely demonstrates (6). A high index of suspicion and effective collaboration between dental and ENT specialists are essential elements to promptly diagnose and treat these conditions, mostly in a combined fashion, as our series and the literature both confirm (4, 11, 13-15, 17, 30, 31). Such collaboration is crucial in order to avoid troublesome and possibly dramatic sequelae, since greater involvement of paranasal sinuses or a straight extension to cervical-fascial spaces can be addressed by the ENT specialist only, while the role of the dentist remains essential in transoral removal of the causative odontogenic agent (11).

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